ND GIS Users Conference

Sept 29 Fargo, ND

Innovations in Aerial Imagery

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PICTOMETRY® AN EAGLEVIEW COMPANY

Innovations in Aerial Imagery – Agenda

- Aerial Imagery (photography) Background
- Innovations & Advancements
  - Ground Sample Distance (GSD) / Resolution
  - Orthos vs. “Bird’s Eye”
  - Sensor & Processing Technology
  - Users (Traditional vs. Non-Traditional)
  - Aerial Imagery Technology – for Indoors?
  - Beyond the Pixels
- GIS Innovations
- Next Frontier

Definition

- **Aerial photography (imagery)** is the taking of photographs of the ground from an elevated position. Usually the camera is not supported by a ground-based structure. Platforms for aerial photography include fixed-wing aircraft, helicopters, multirotor Unmanned Aircraft Systems (UAS), balloons, blimps and dirigibles, rockets, pigeons, kites, parachutes, stand-alone telescoping and vehicle-mounted poles

http://en.wikipedia.org/wiki/Aerial_photography

What is this?

- 'Boston, as the Eagle and the Wild Goose See It‘
  - Taken by James Wallace Black and Samuel Archer King
  - October 13, 1860
- Oldest Aerial Photograph on record!
- Old South Meeting House
  - Where the Boston Tea Party was launched in 1773

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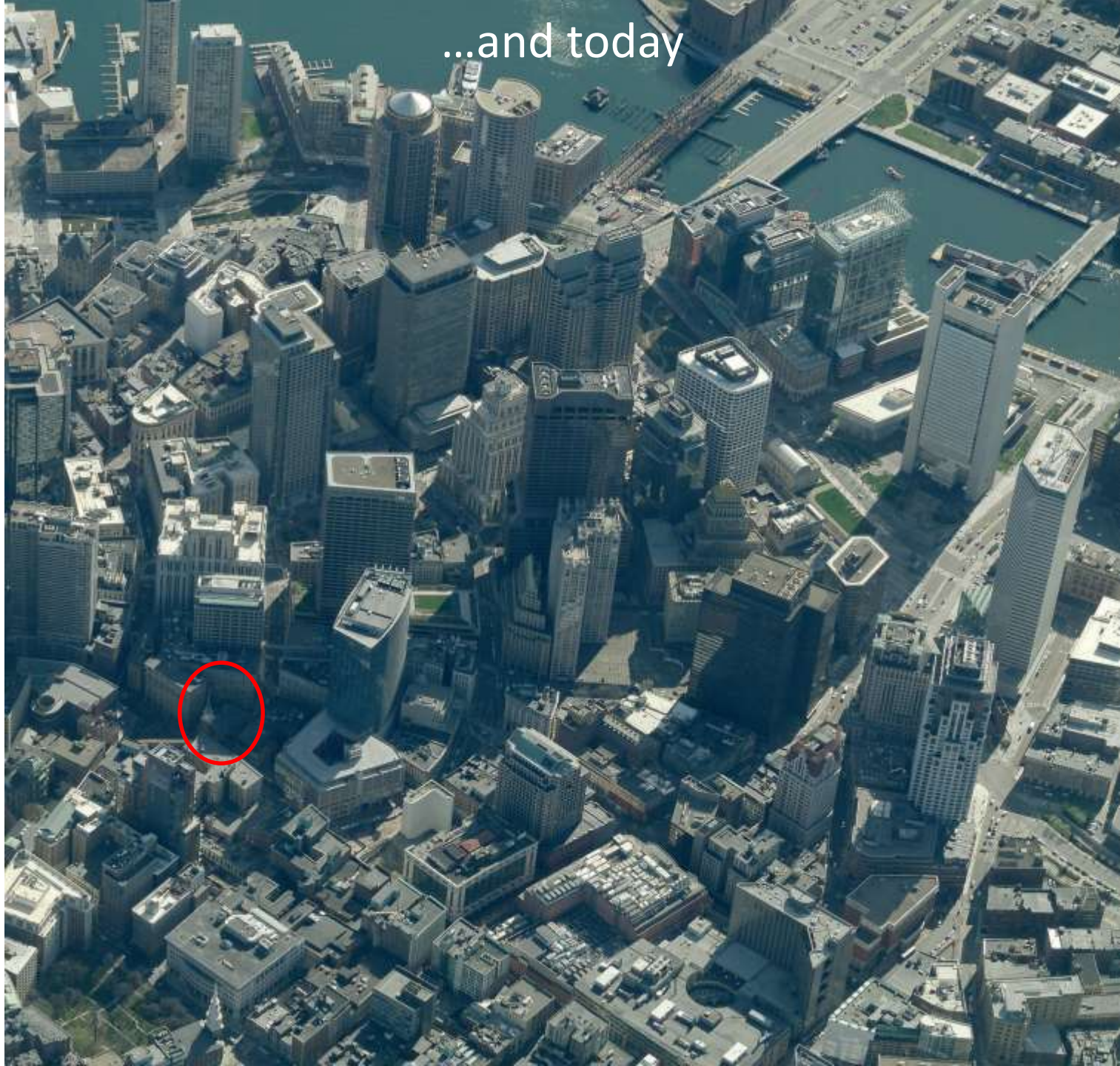


Aerial Imagery – Historical Timeline

1858: Aerial photography first practiced by the French photographer and balloonist Gaspard-Félix Tournachon, known as “Nadar” in 1858 over Paris, however the photographs no longer exist

1860: 'Boston, as the Eagle and the Wild Goose See It‘ (oldest on record)

1882: Kite aerial photography was pioneered by E.D. Archibald

1887: Germans began experiments with aerial photographs and photogrammetric techniques for measuring features and areas in forests

Late 1800’s – early 1900’s: Further experimentation relating to aerial imagery captured by balloons, kites, compressed air rockets, pigeons, etc.

1909: Wilbur Wright takes first aerial photograph from an airplane of Centocelli, Italy

1914-1918 (World War I): Rapid maturation of the technology during the war, as reconnaissance aircraft were equipped with cameras to record enemy movements

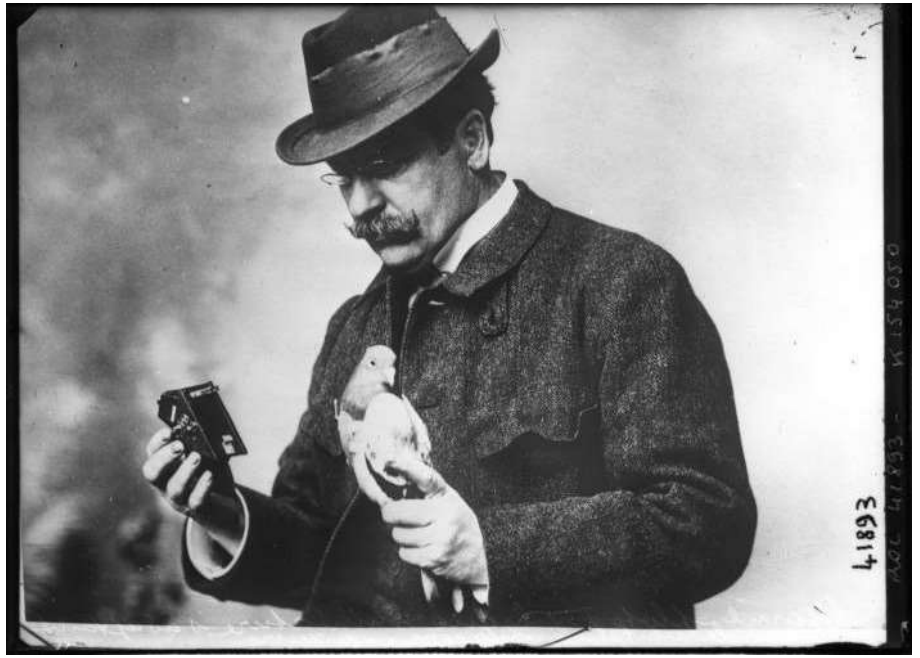
WWI - Reconnaissance

Aerial Imagery – Historical Timeline

Post World War I

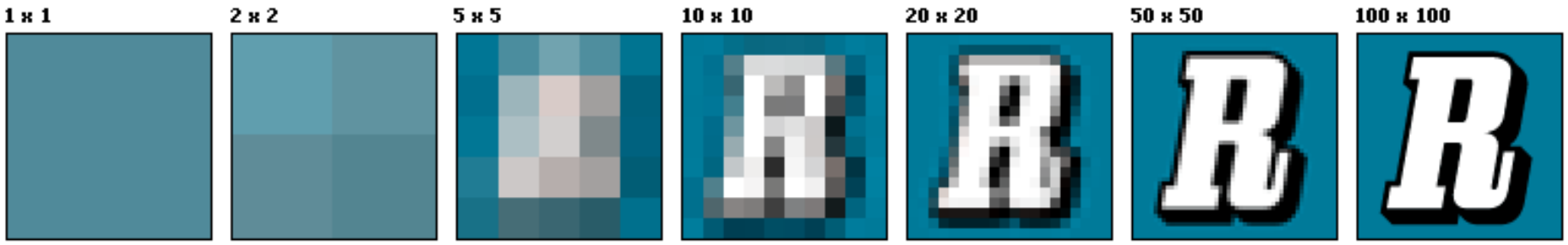
- Commercial aerial photography begins
- Use greatly expanded during World War II, as reconnaissance technology and interpretation capabilities significantly improved
- Numerous technological enhancements, which are still continuing today…
  - Color-infrared / False Color
  - Multi-spectral

Innovations & Advancements



Innovations: GSD

- Ground Sample Distance – distance between the center of pixels
- Resolution – the capability of a sensor to observe or measure the smallest object clearly with distinct boundaries; higher resolution means more detail
- Pixel – a unit of a digital image; resolution depends upon the size of the pixel



Innovations: GSD

How has Ground Sample Distance improved over the years?


2-meter GSD (1:4,800 scale)


2-meter GSD (1:2,400 scale)


2-meter GSD (1:600 scale)


1-meter GSD (1:600 scale)


0.5-meter GSD (1:600 scale)


12-inch GSD (1:600 scale)


9-inch GSD (1:600 scale)


6-inch GSD (1:600 scale)


4-inch GSD (1:600 scale)


2-inch GSD (1:600 scale)


2-inch GSD (1:100 scale)

Less than 1-Inch!

Innovations: Orthos vs. “Bird’s Eye”

Ortho Imagery

- Orthophotography has the geometric characteristics of a map, and the image qualities of a photograph. These qualities allow for:
  - distance & area measurements
  - determination of feature shape
  - direction calculations / routing
  - determination of coordinates at any location

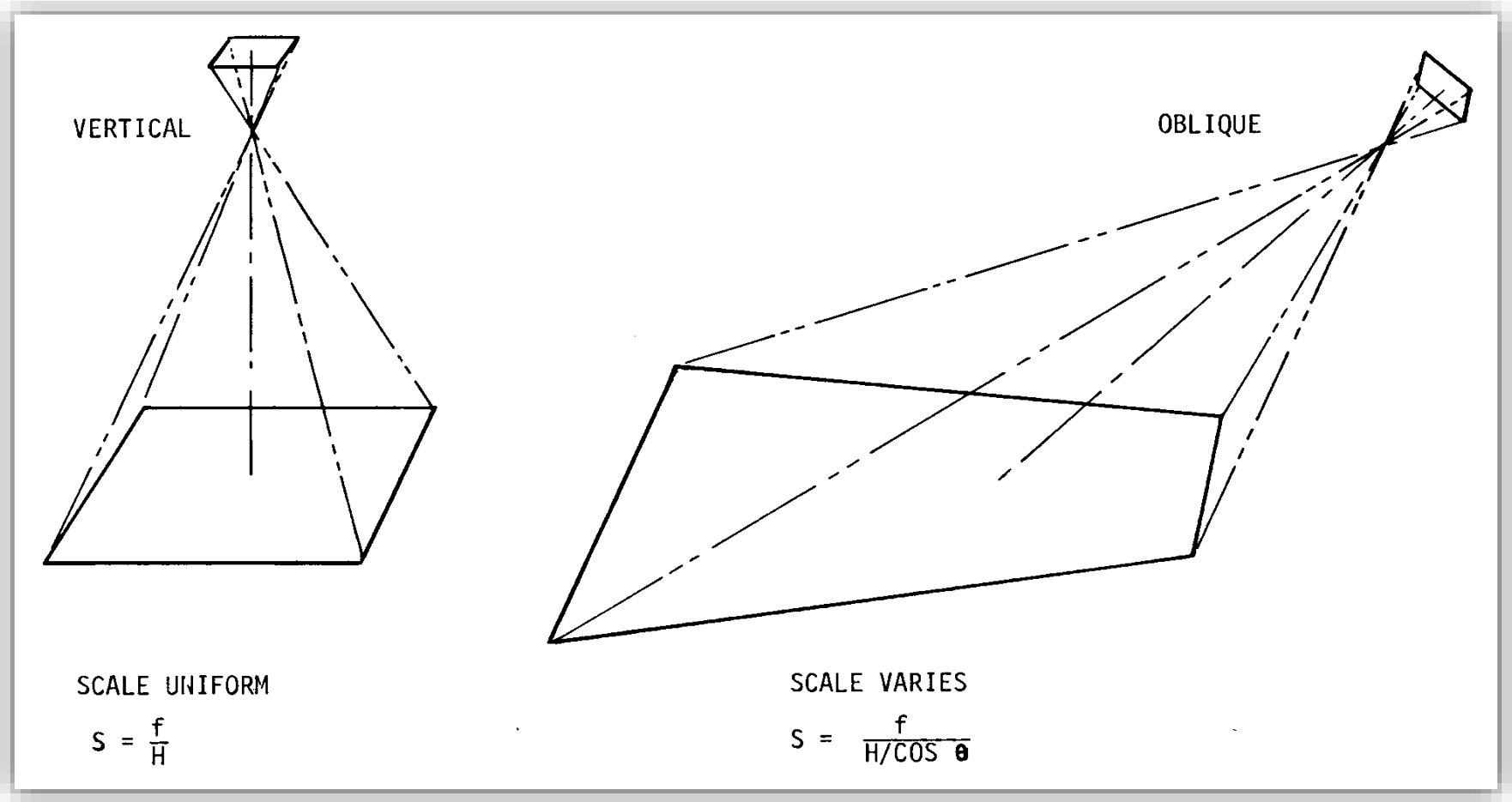
Oblique Imagery

- Oblique imagery is captured at an approximate 40-45 degree angle, providing unique intelligence and analysis capabilities that are not available with an orthophoto.

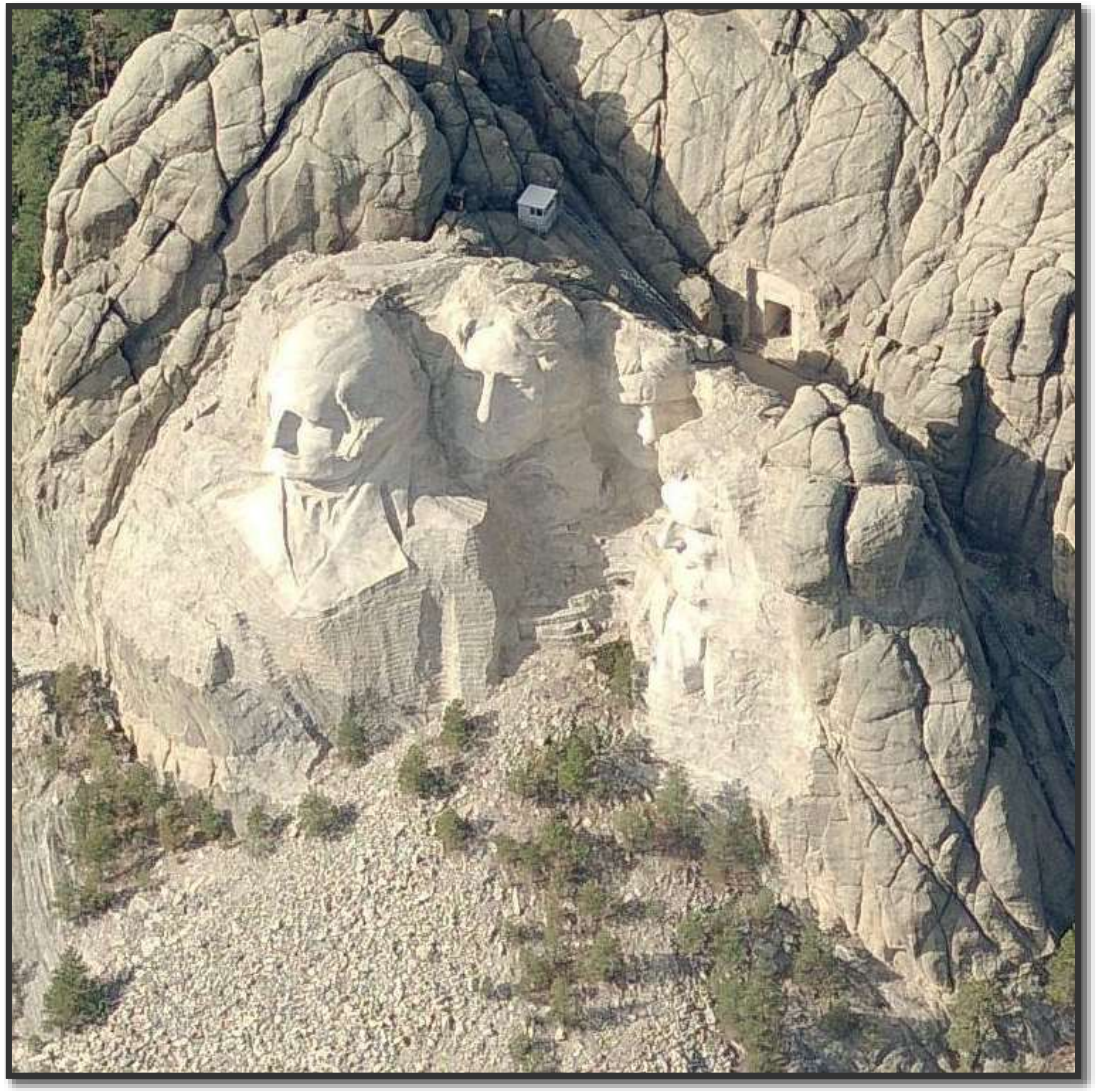
- Also referred to as…
  - Angled Imagery, Birds-eye View, etc.

Intelligent Oblique Imagery

- Ortho vs. Oblique:



Traditional Oblique Image



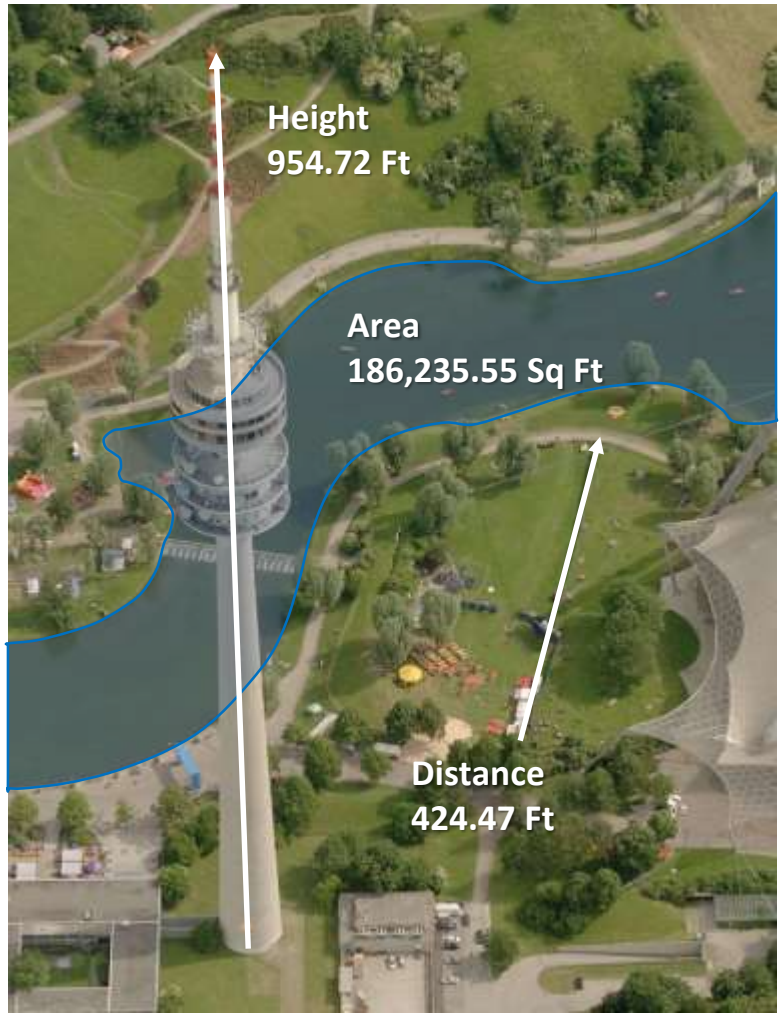
What and where is this feature? (Keystone, SD)

Oblique imagery brings a natural perspective to a location that allows a user to view the environment as if they were there.

So In Addition To This…

You Get This…

Intelligent Oblique Imagery



Intelligent Imagery – each pixel has X, Y and Z values. Measure right on the image:

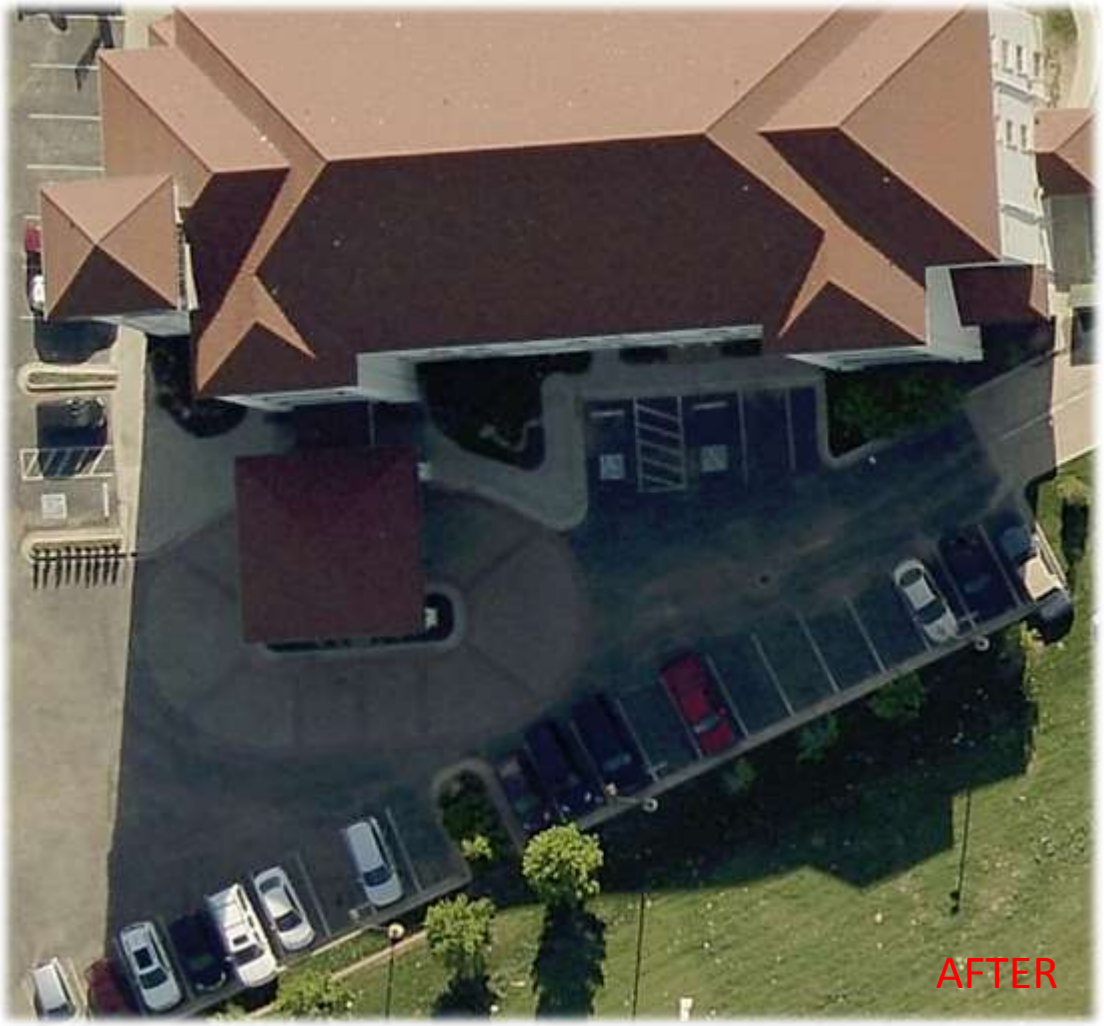
- Distance
- Area
- Height
- Elevation/Slope
- Bearing
- Angle

Innovations: Sensor & Processing Technology

- Advancements in the areas of sensor technology, capture processes, and image processing technologies have combined to result in more usable, and overall better quality imagery

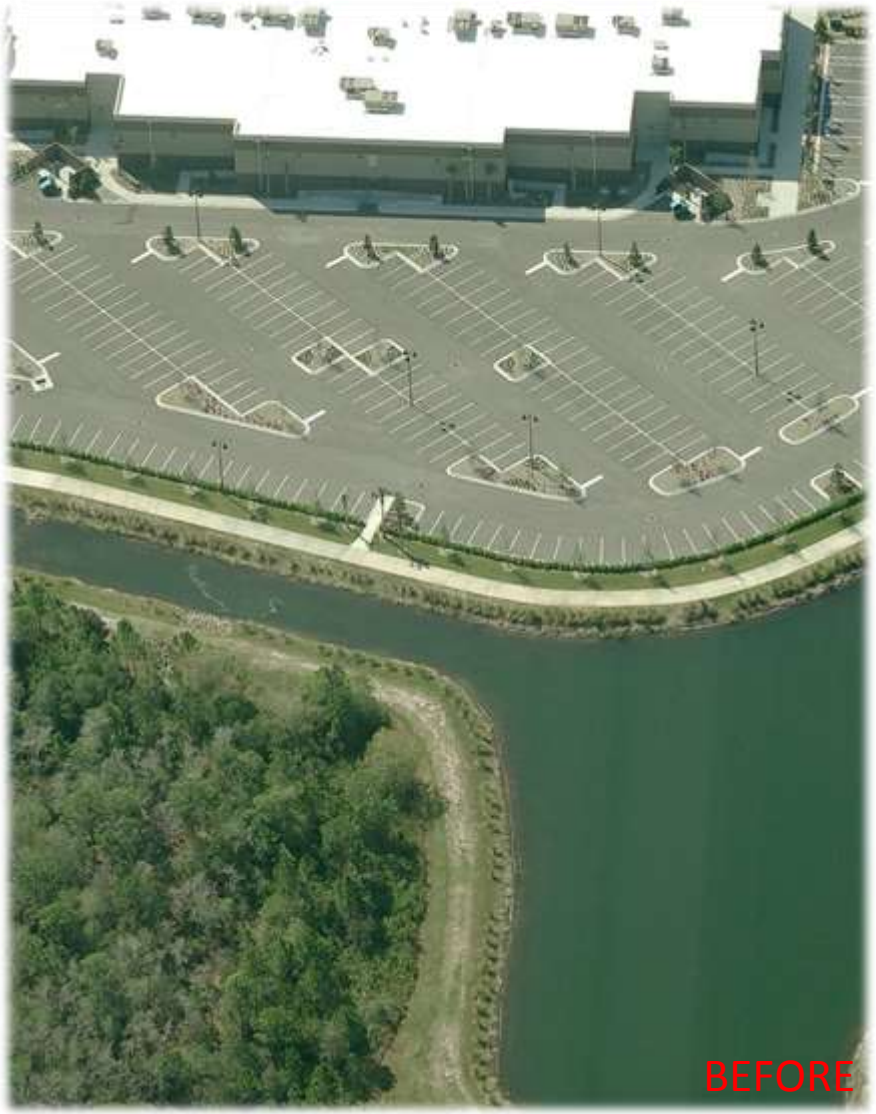
- Some examples of these enhancements are:
  - Shadow Adjustments
  - Noise Reduction
  - Smear Control
  - Mosaic Smoothing

Shadow Adjustments



Noise Reduction

Smear Control



Mosaic Smoothing

Innovations: Users

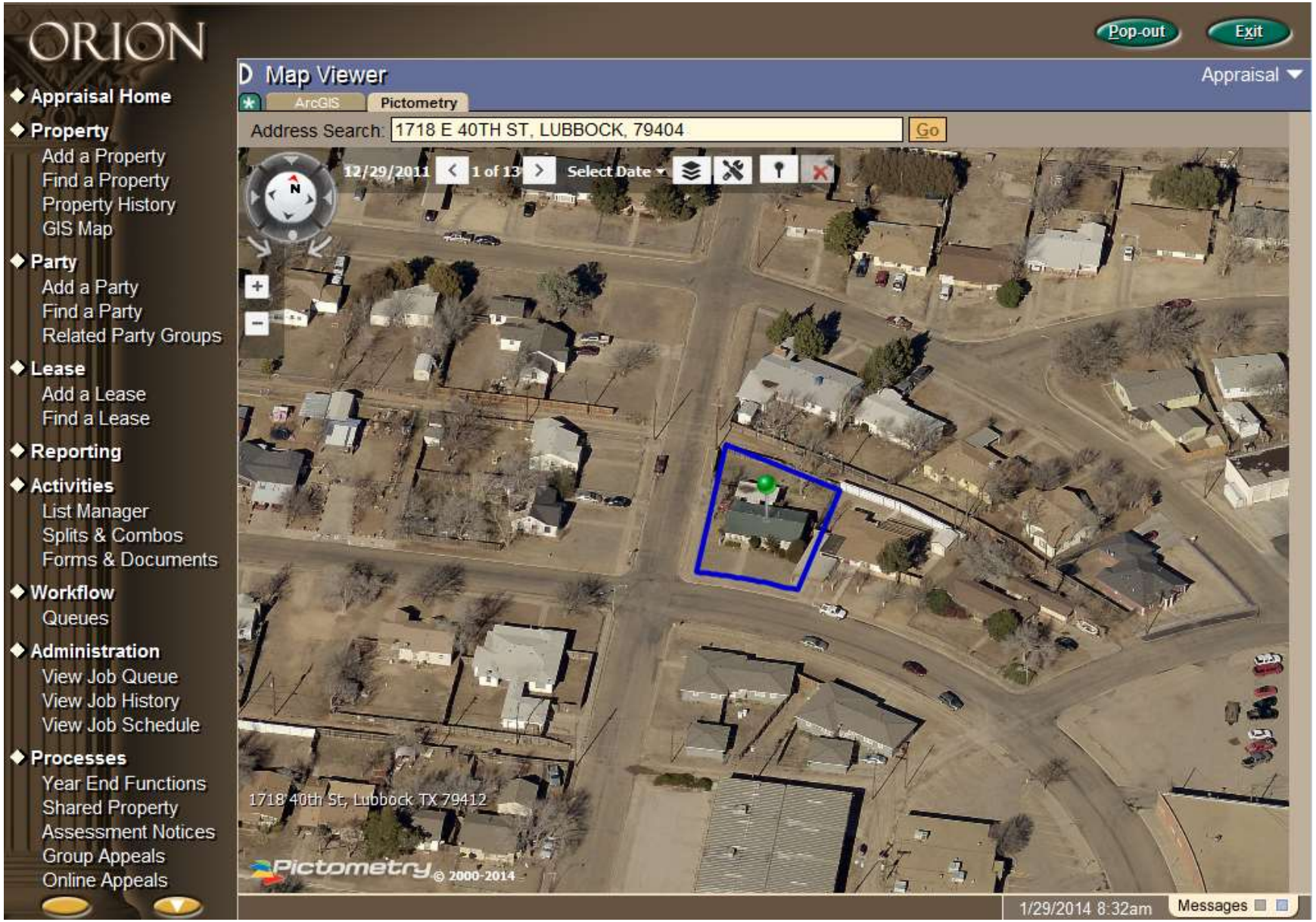
- Traditional Aerial Imagery Users
  - GIS
    - Mapping, Data Management, Spatial Analysis, etc.
  - Planning / Zoning
    - Comprehensive Plans, Historic Preservation, Revitalization Studies, etc.
  - Agriculture
    - Precision Agriculture, Sustainability, etc.
  - Engineering / Surveying
    - Planning, Site Design, Environmental Analysis, Maintenance, etc.
  - Transportation
    - Facilities Management, Design, Travel Demand Studies, etc.
  - Public Works / Utilities
    - Asset Management, Construction Management, etc.

Innovations: Users

- Non-Traditional Aerial Imagery Users
  - Property Appraisers / Assessors
  - 9-1-1 Call Taking and Dispatch / Public Safety (Police, Fire, EMS)
  - Code Enforcement / Compliance
  - District Attorney & Prosecutors
  - Economic Development
  - Media

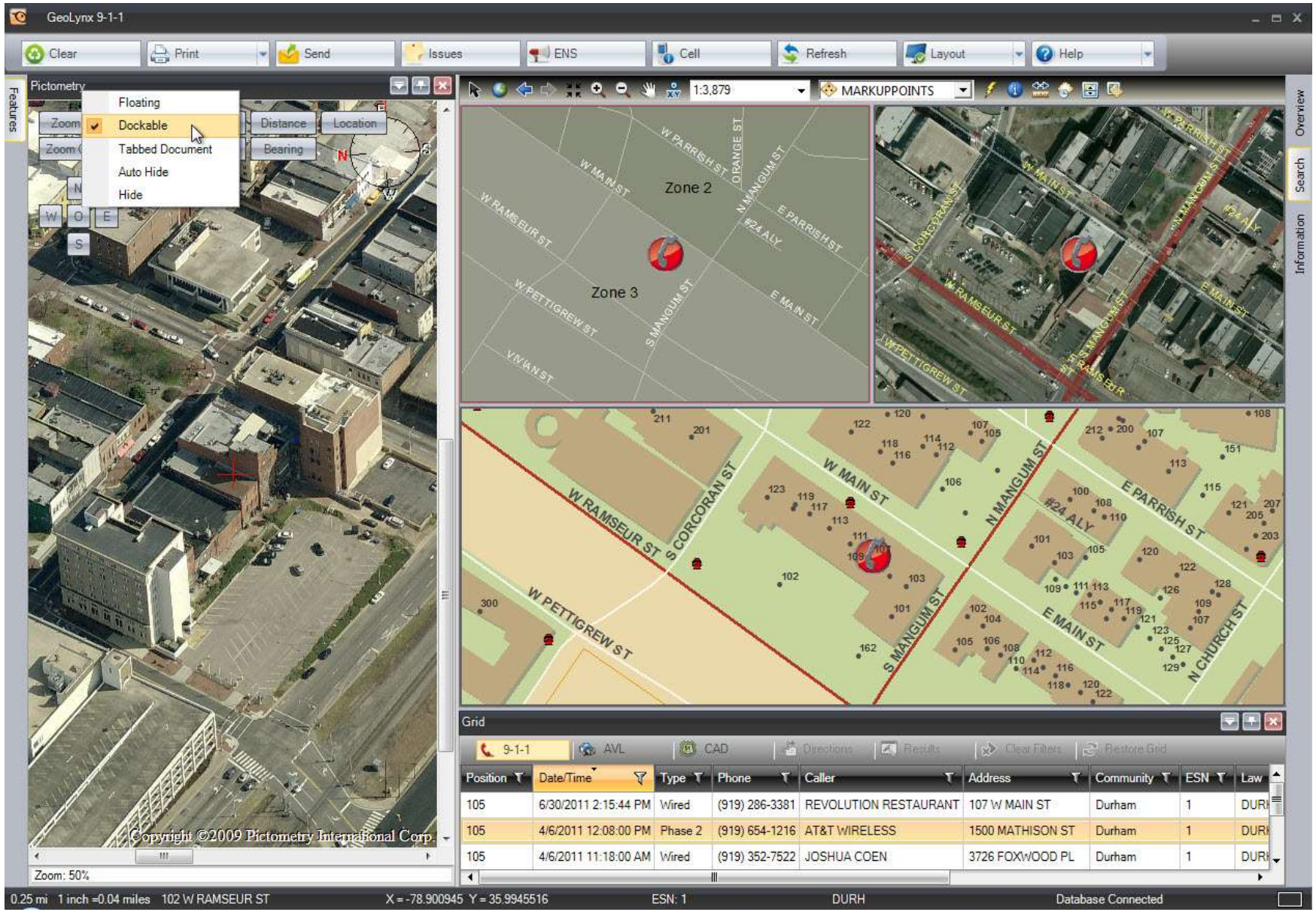
Property Appraisers / Assessors

- Preview properties for new construction and/or changes prior to field visit
- Potentially reduce field visits, saving time and resources
- Evidence for formal and informal appeals
- Investigate land use classifications and exemptions, such as agricultural use or commercial
- Integrates with GIS, CAMA and other 3rd party systems



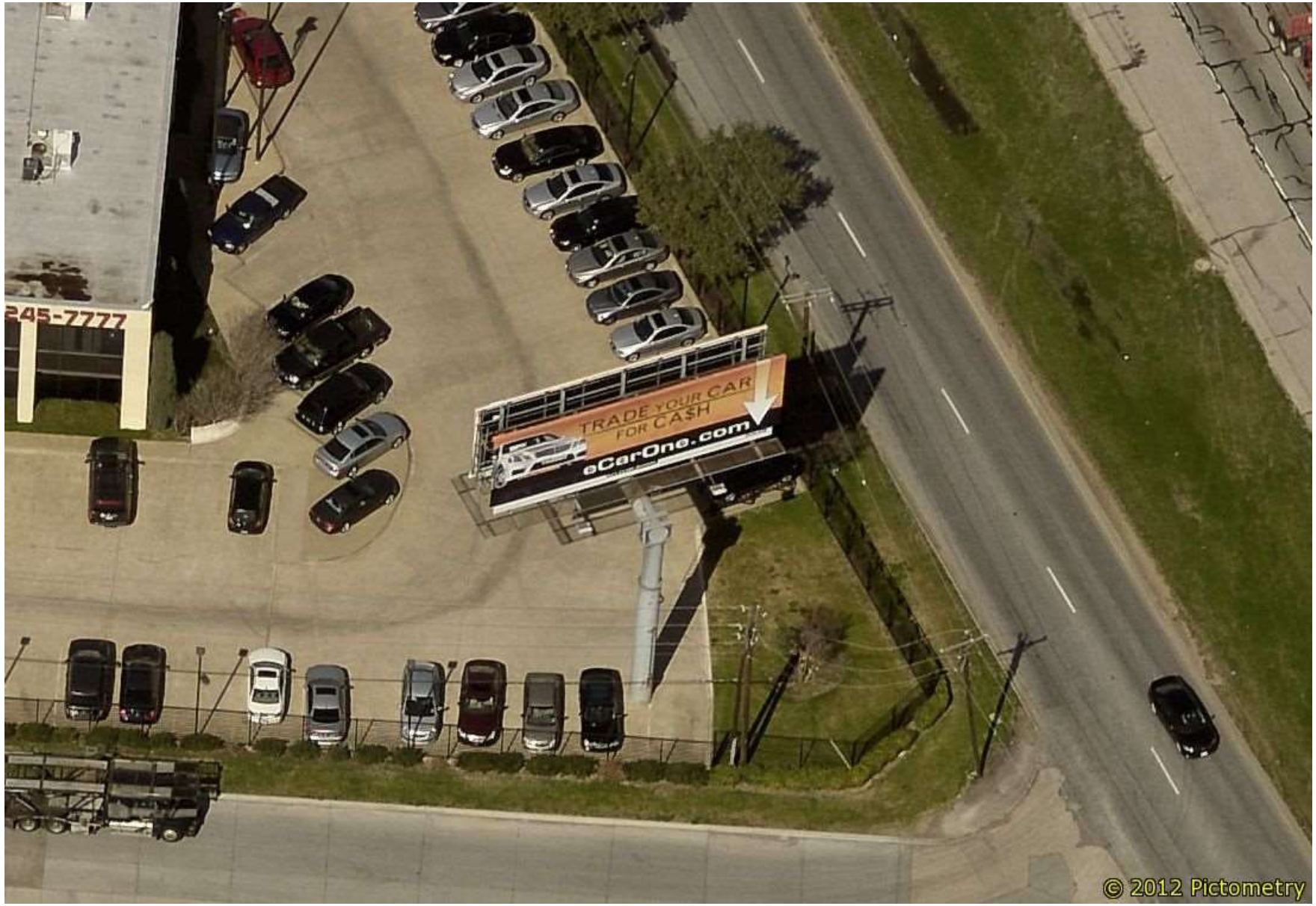
9-1-1 / Public Safety (Police, Fire, EMS)

- Turn night into day, and winter into summer
- Historical archiving and accident reconstruction
- Search, raid and seizure planning
- Photo documentation for search warrant requests
- Pre-plan responses for major structure fires
- Measure hose distance from water sources and fire hydrants
- Inspect structural compositions, roof layout and access points



Code Enforcement / Compliance

- Building permit enforcement for residential and commercial properties
- Advertising / signage regulations

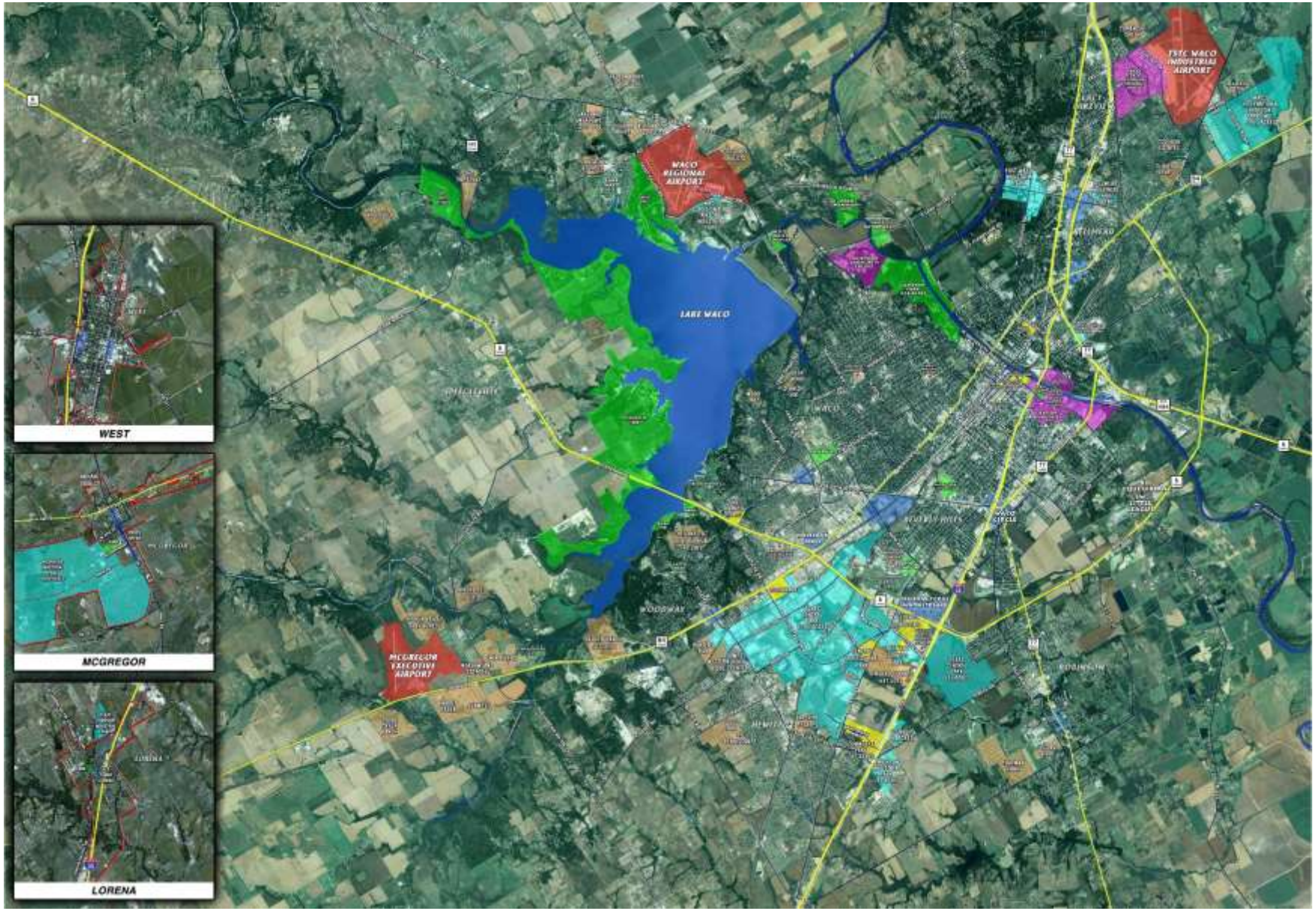


District Attorney & Prosecutors

- Provides a jury with context of a crime scene, which is often critical to understanding how a series of events took place

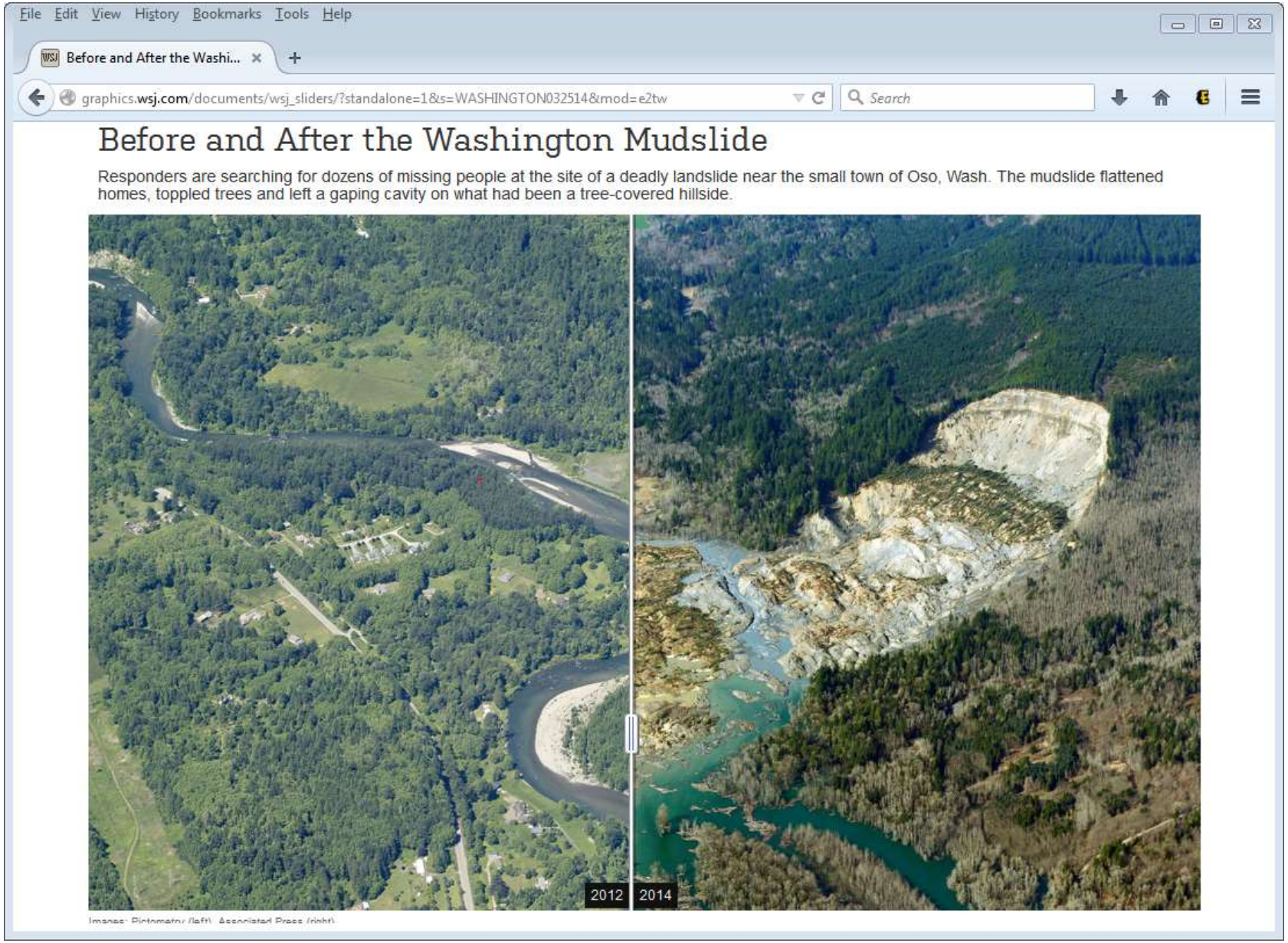
Economic Development

- Attract business to your jurisdiction
- Business park, abatement zone analysis
- Interactive maps for developers and residents
- Project tracking and visualization



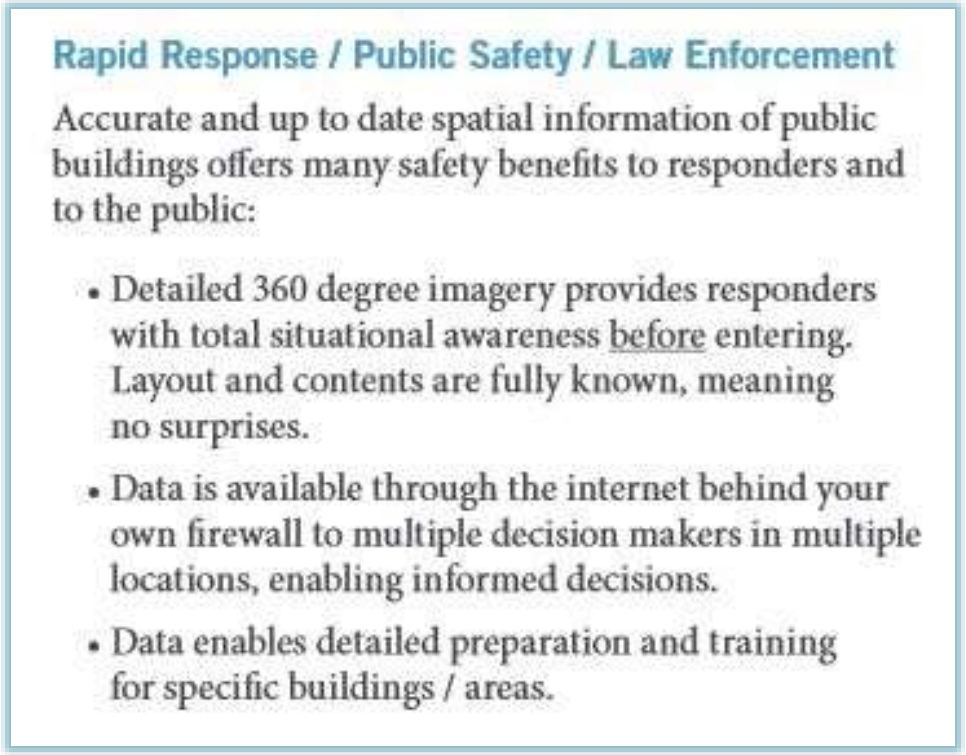
Media

- More than just a map!
- Provides visual evidence of an events location; no longer left to the audience's imagination
- Often used after natural disasters



Innovations: Aerial Imagery, Inside?

- What would happen if we migrated aerial imagery and mapping technology indoors?
- Who would benefit from it?

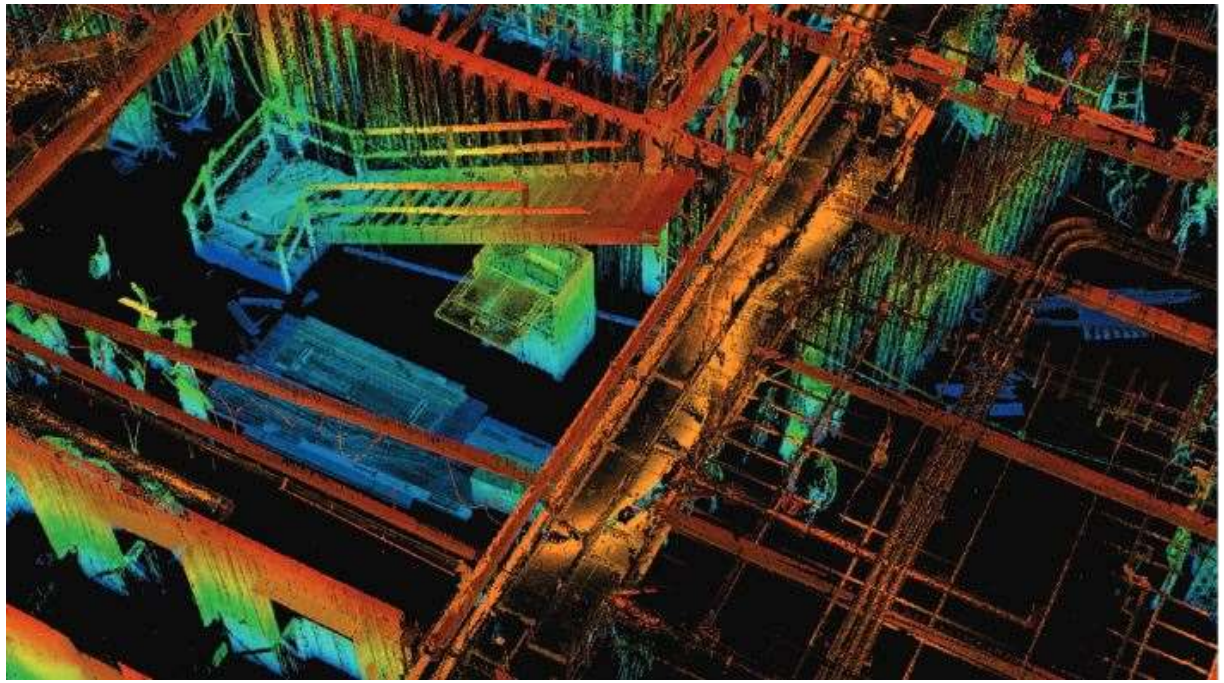


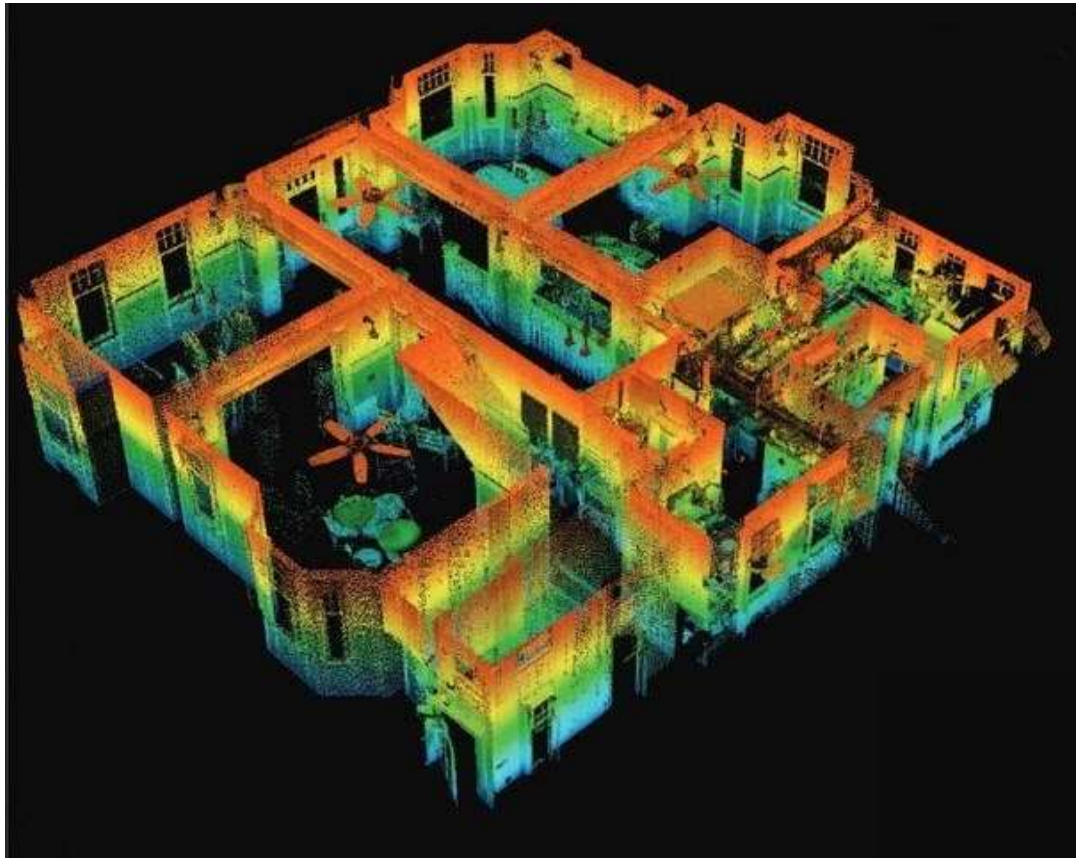
Rapid Response / Public Safety / Law Enforcement

Accurate and up to date spatial information of public buildings offers many safety benefits to responders and to the public:

- Detailed 360 degree imagery provides responders with total situational awareness before entering. Layout and contents are fully known, meaning no surprises.
- Data is available through the internet behind your own firewall to multiple decision makers in multiple locations, enabling informed decisions.
- Data enables detailed preparation and training for specific buildings / areas.

Innovations: Indoor Mapping





Innovations: Indoor Mapping

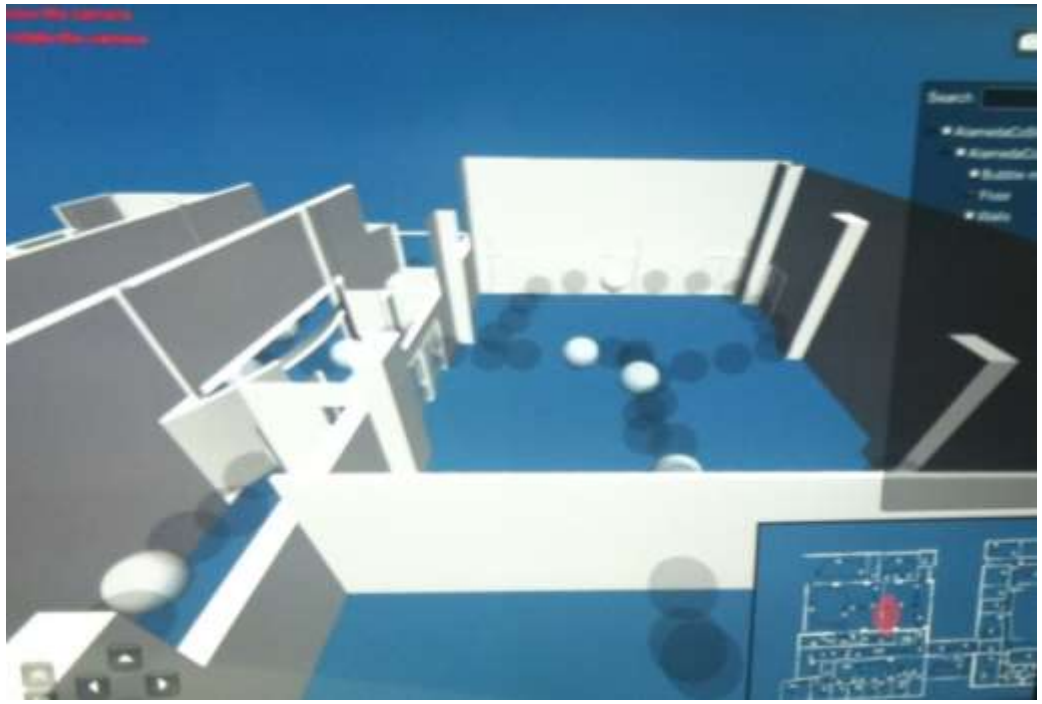
LiDAR Scan of Building Contents and Image Capture Points – Overhead View

LiDAR Scan of Building Contents and Image Capture Points – 3D Perspective View

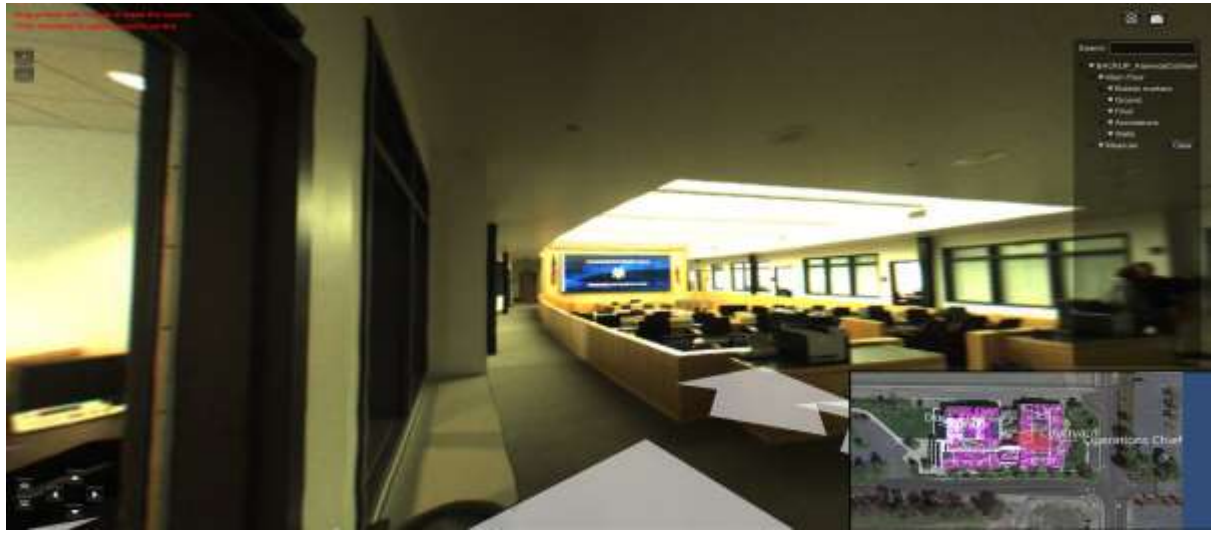
Innovations: Indoor Mapping

Innovations: Indoor Mapping

3D Floor Plan and Selected Image Capture Points



High Resolution, Geo-referenced Imagery of Interior



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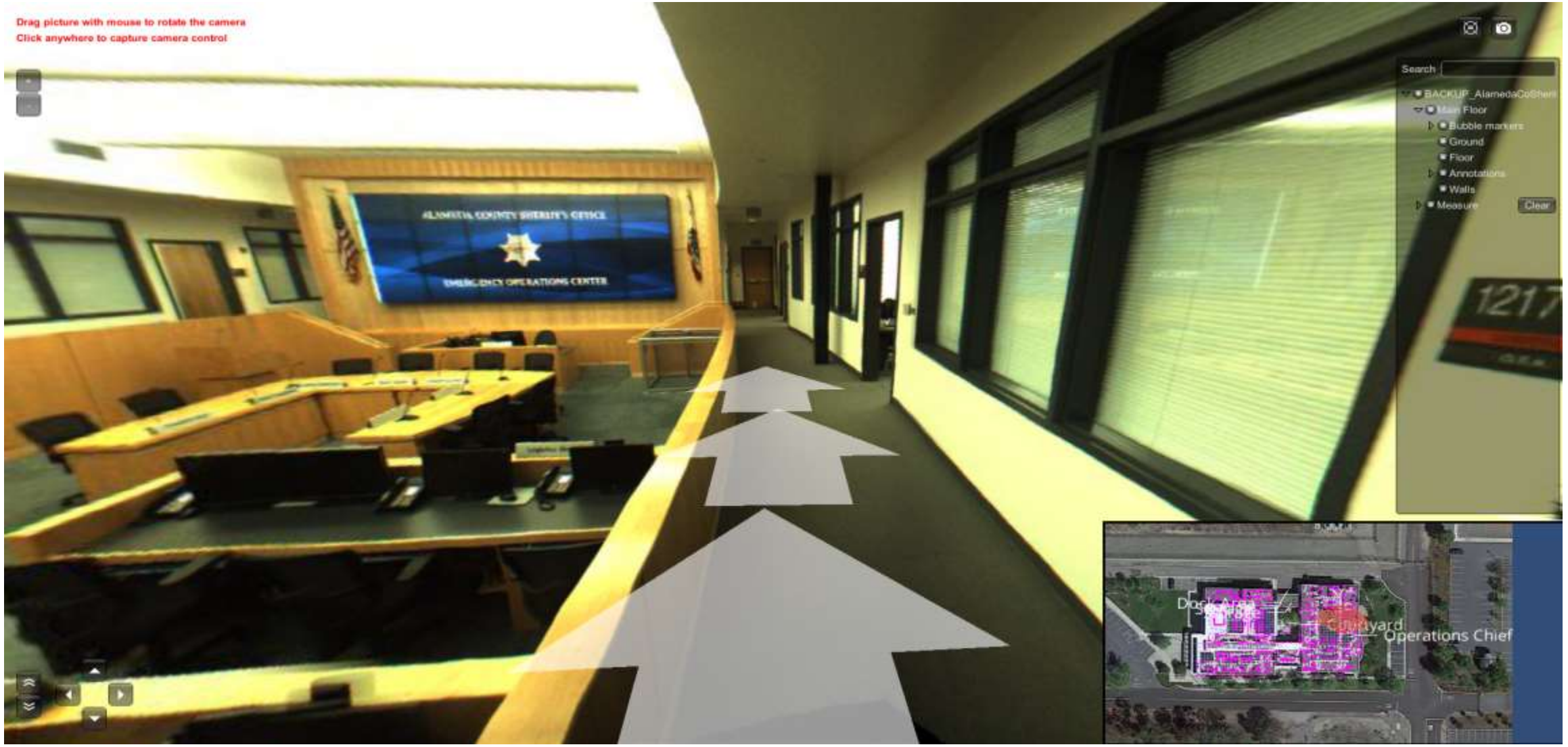

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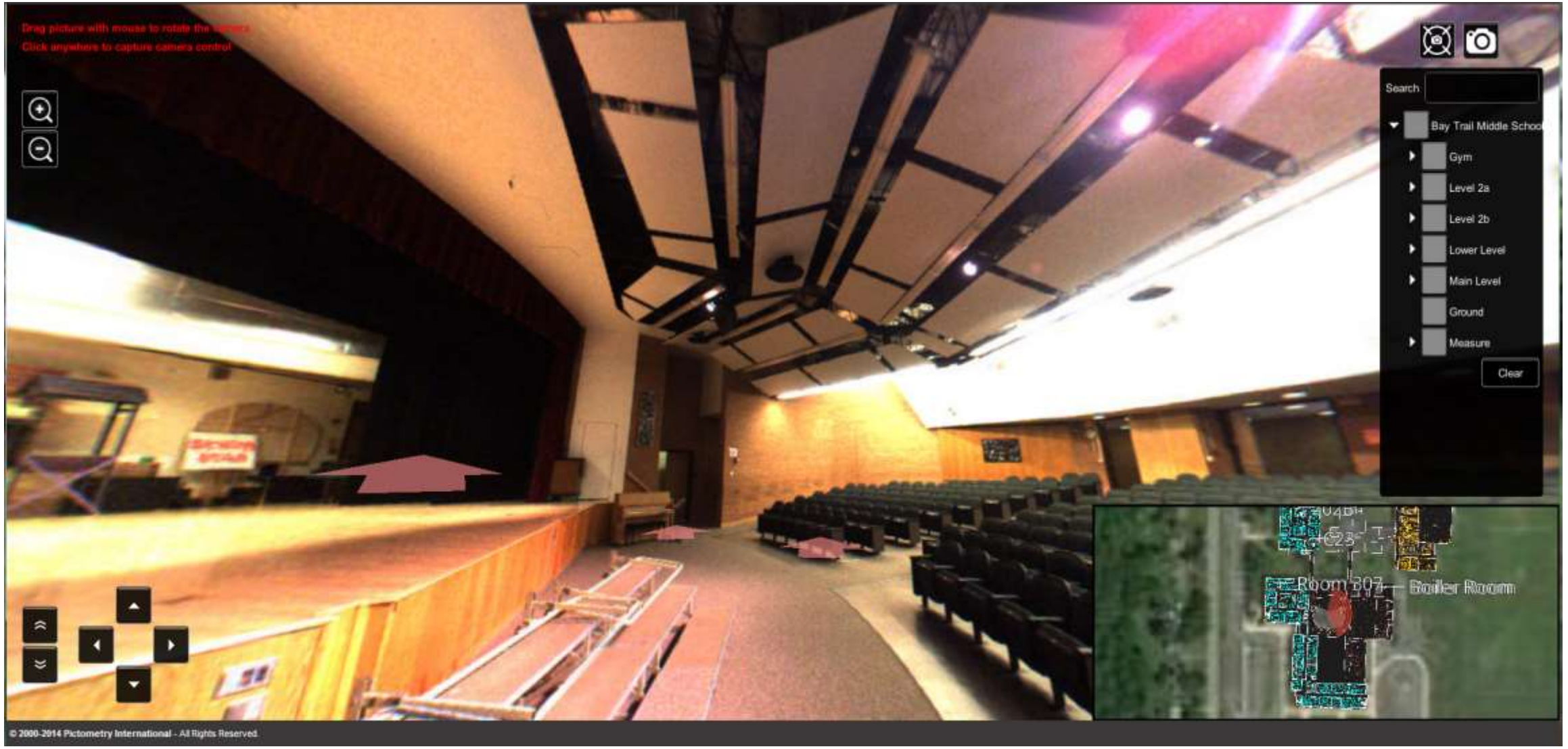


Innovations: Beyond the Pixels

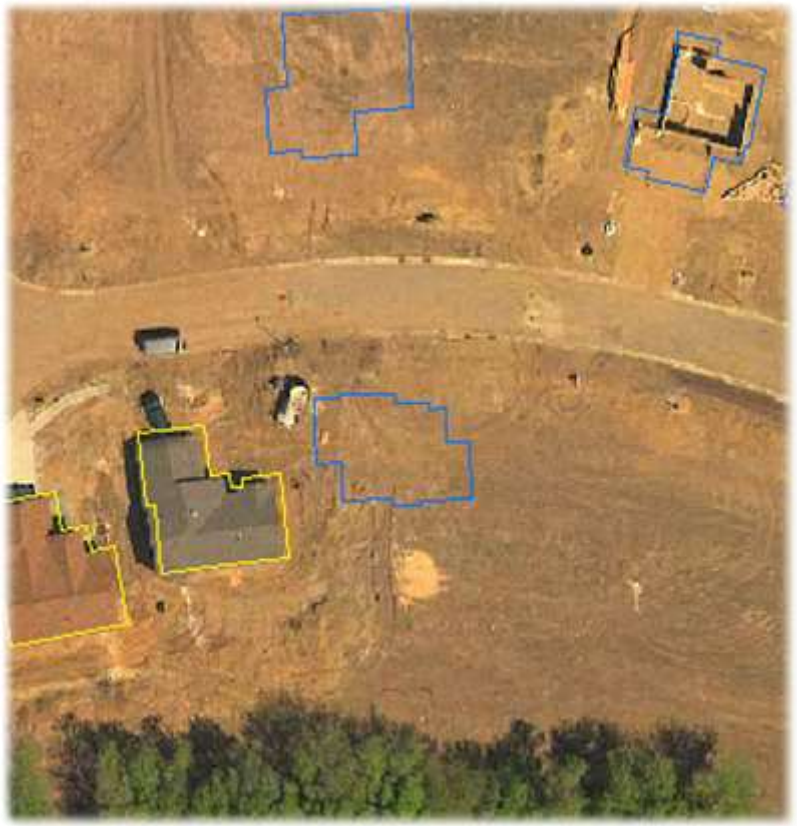
- Change Detection
- Feature Mapping / Data Mining
- Planimetric Mapping
- Impervious Surface Analysis

Change Detection

Utilizing aerial imagery to detect changes over time…for example – structures.

Change Detection – Example

New



2010

2013

Change Detection – Example

Changed

2010

2013

Change Detection – Example

Demolished

2010

2013

Feature Mapping / Data Mining

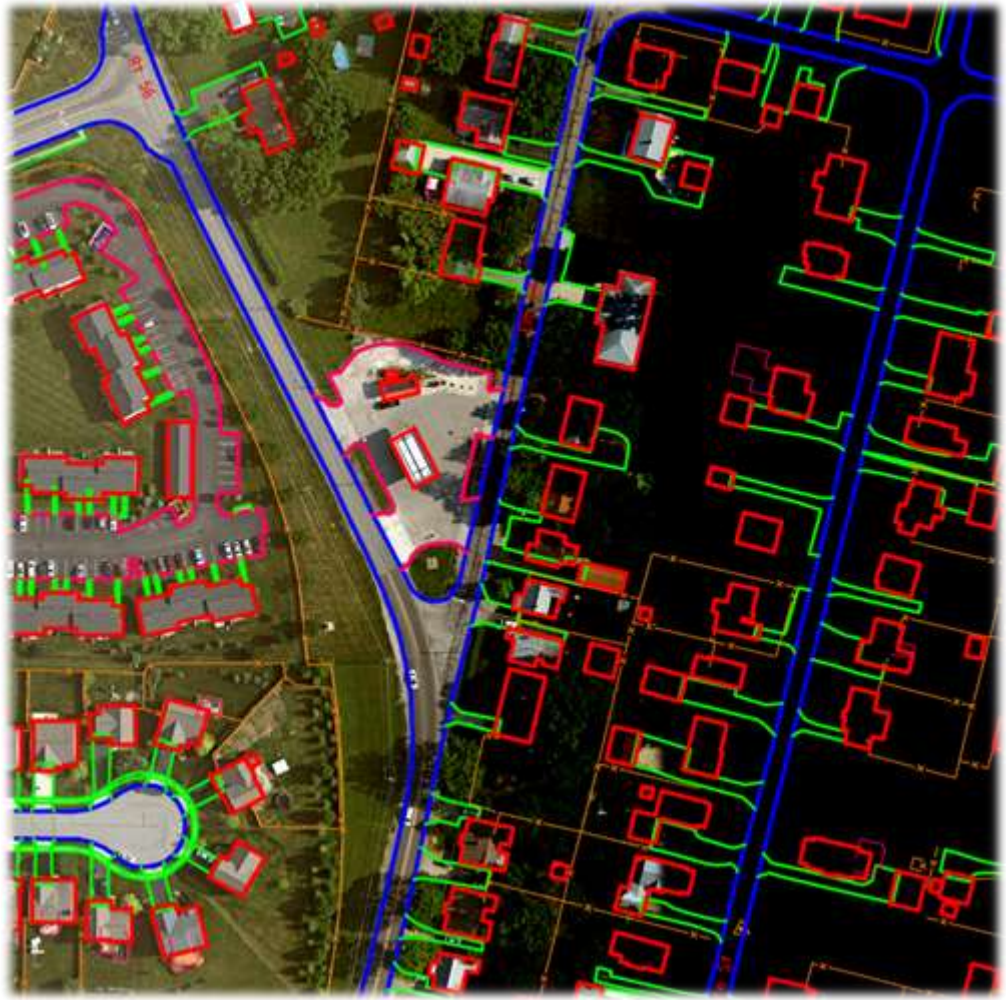
Utilizing aerial imagery to locate and inventory features of interest…for example – propane tanks.

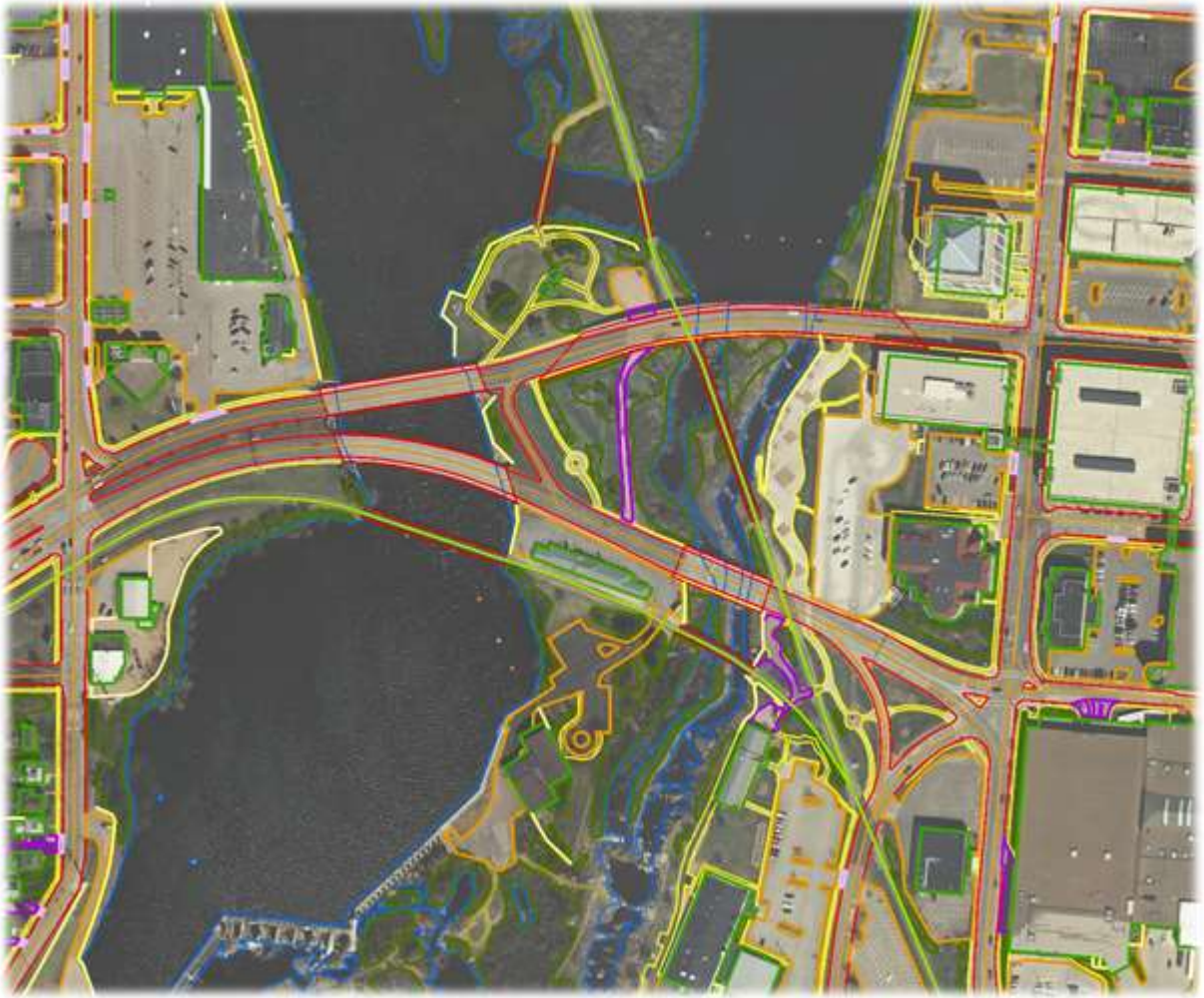
Feature Mapping / Data Mining

…or Utility Poles and Lights.

Planimetric Mapping

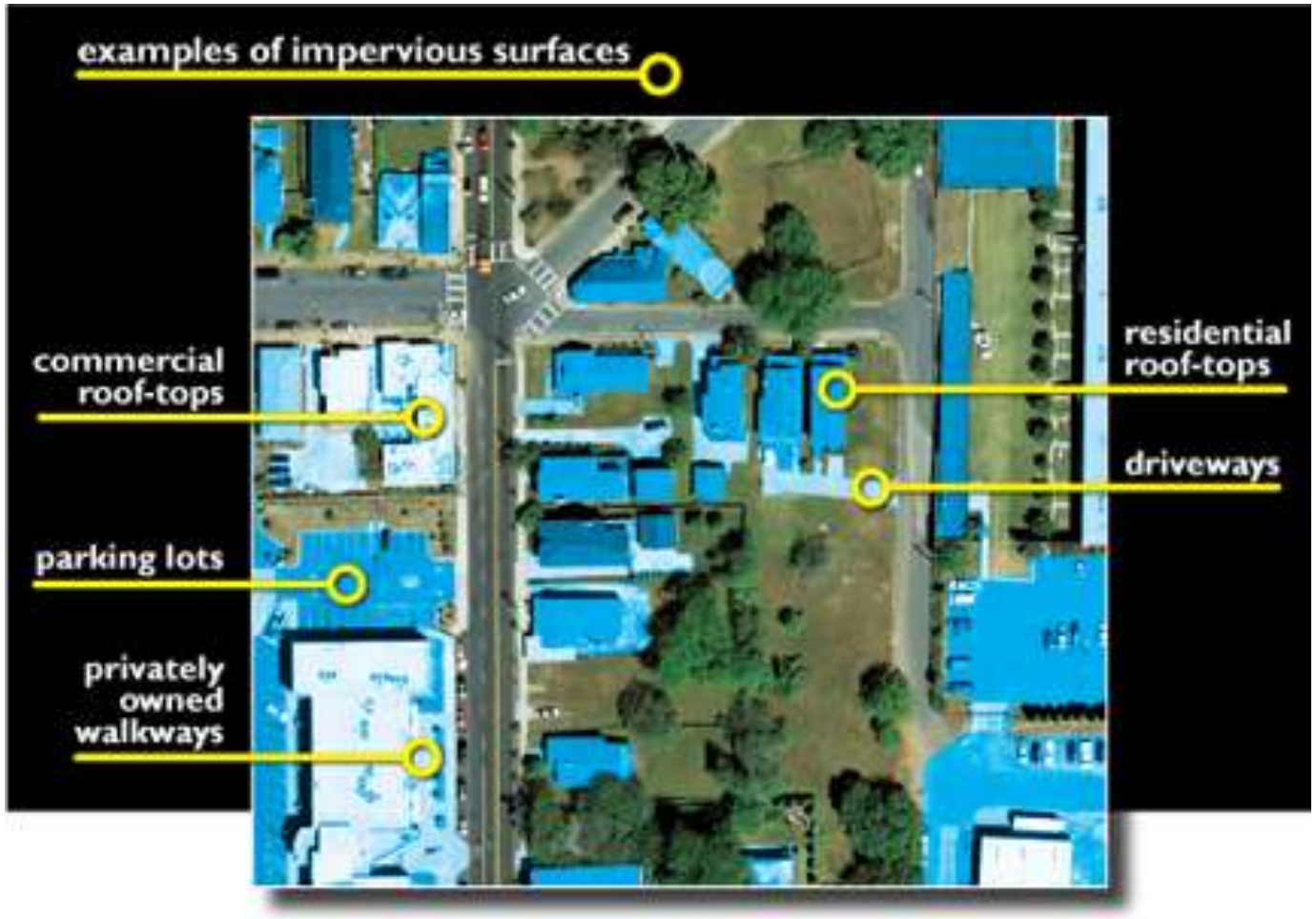
Utilizing aerial imagery to accurately digitize cultural and natural features,
to the correct scale and position…for example – street centerlines, curbs, and driveways.





Impervious Surface Analysis

Utilizing aerial imagery to identify any analyze man-made, impervious surfaces – which include things like sidewalks, driveways, rooftops and parking lots.



Impervious Surface Analysis

Large-scale, Community-wide Analysis

Property-centric Analysis

Impervious Surface Analysis

Utilizing color infrared (CIR) imagery to differentiate between vegetated and non-vegetated areas is often a critical part of the impervious surface analysis.

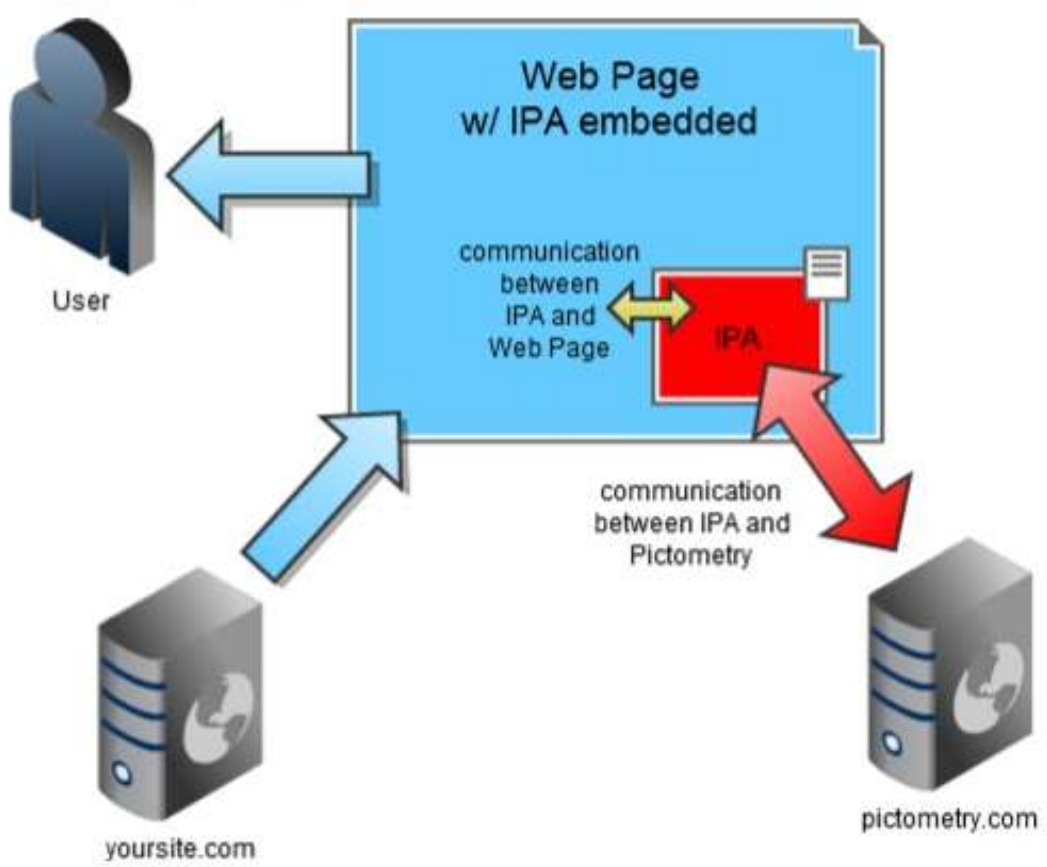
GIS Innovations

Here’s what Pictometry has developed to bring this imagery into existing workflows

GIS Innovations

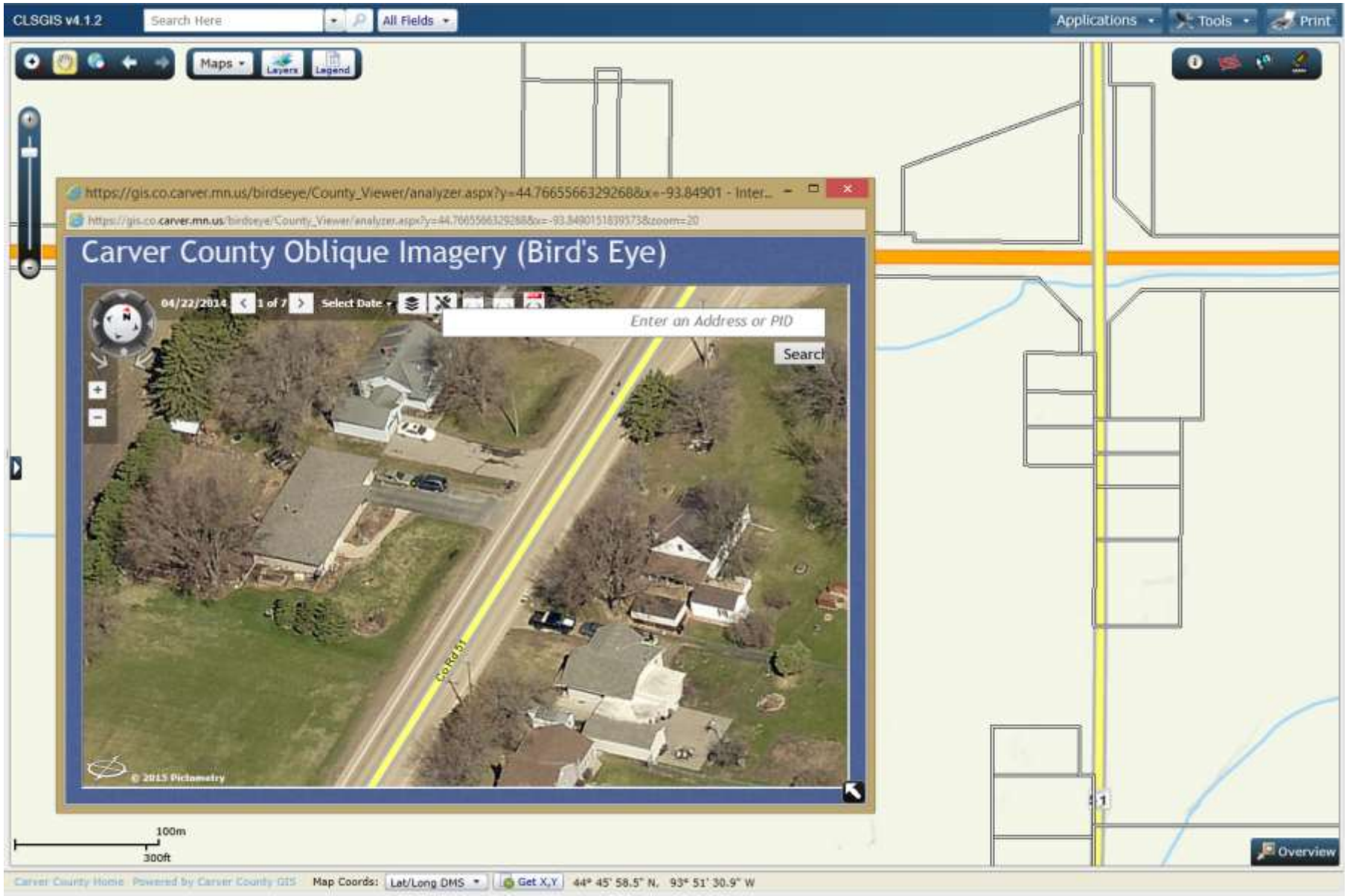
Here's what Pictometry has developed to bring this imagery into existing workflows

API (Integrated Pictometry Application – IPA)



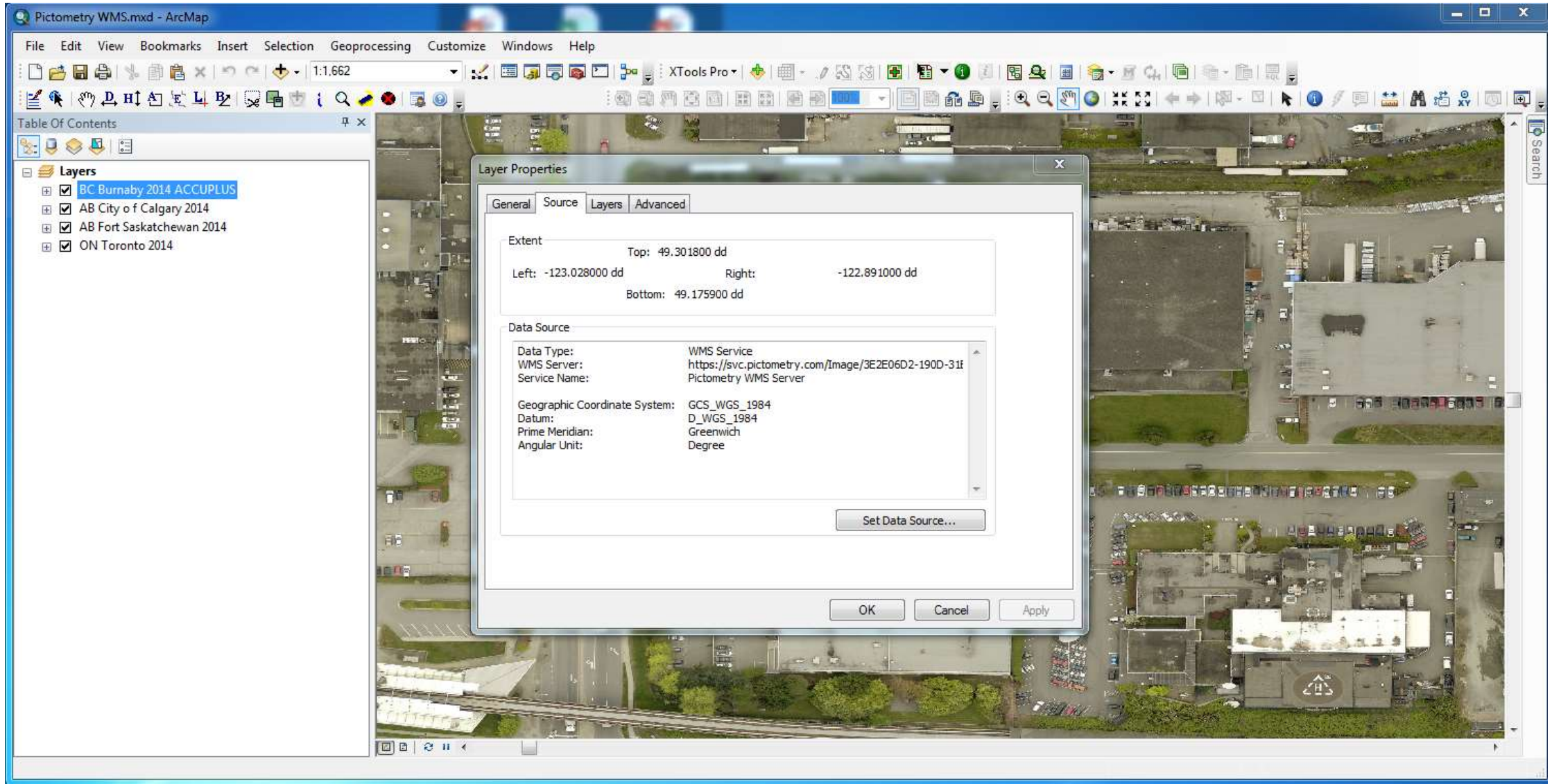
GIS Innovations

IPA



GIS Innovations

WMS



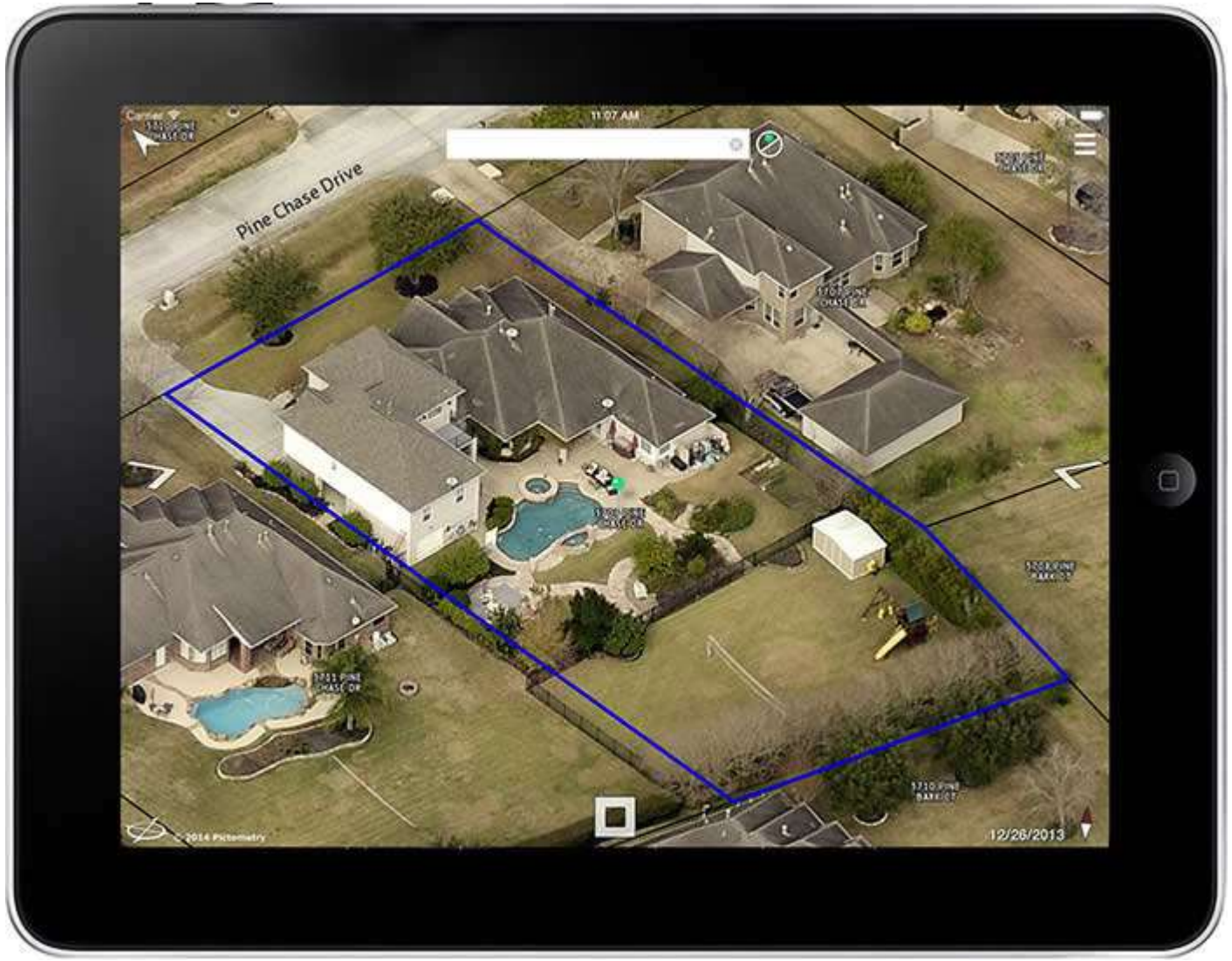
GIS Innovations

AccuPlus

Ceritified authoritative orthomosaic meetings stringent positional and feature correction requirements

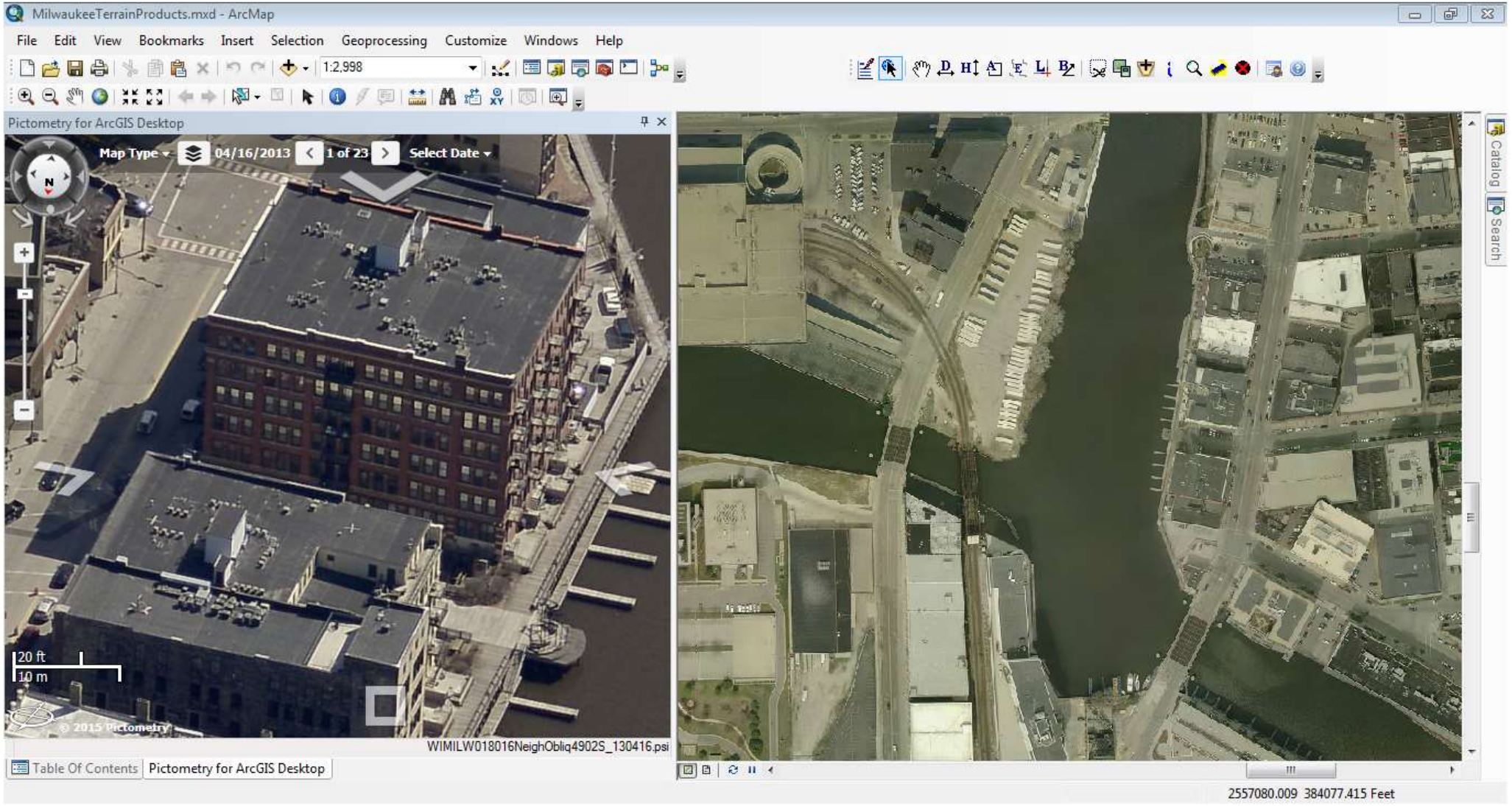
GIS Innovations

iOS / Android Mobile Apps



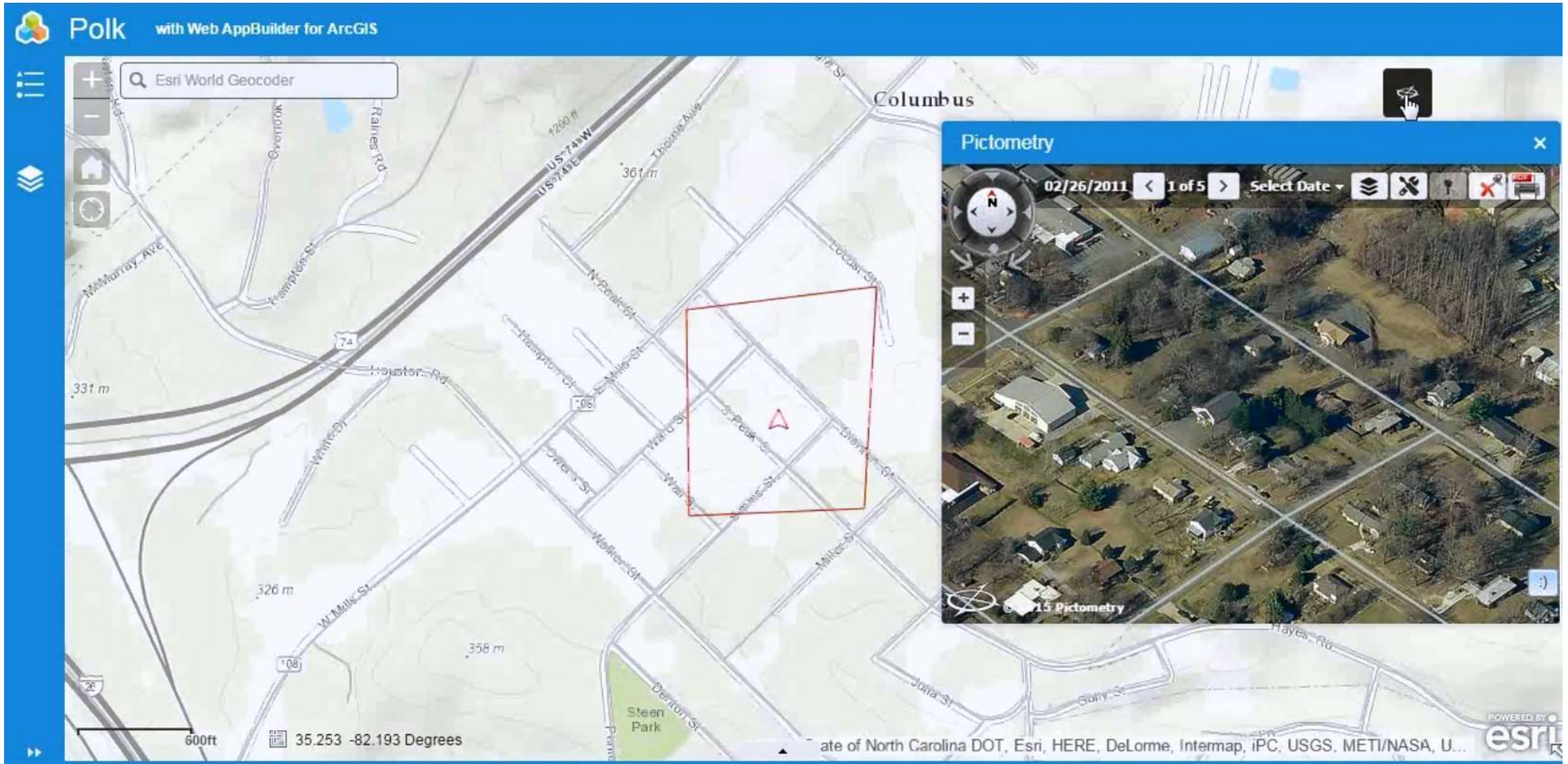
GIS Innovations

ArcGIS Desktop Add-In



GIS Innovations

Web App Builder - Widget



Aerial Imagery’s Next Frontier

Thanks for coming!
Questions?

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